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SCIENCE

NEW YORK, JULY 29, 1892.

RICE CULTURE IN JAPAN, MEXICO, AND THE UNITED STATES FROM THE HYGIENIC POINT OF VIEW.¹

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ONE of the most important problems to be solved by the Japanese medical profession is the application of a rational and efficient hygiene to the culture of rice. This culture lies, so to speak, at the very foundation of Japanese life. When the rice crop is abundant Japan is well fed, healthy, and content; when it fails, Japan droops and starves. Japan almost lives on rice, and, consequently, a considerable part of its population is employed in the culture of rice. This large fraction of the people, at least, is exposed to all the dangers which arise from a careless, imprudent, or slovenly system of cultivation, and the dangers, as every one knows, are very great, and, as every one knows, also, little is done in Japan to obviate them.

Rice culture is a watery business. Almost the whole population of Japan forms around its island a fringe, fifteen miles deep, leaving the interior a comparative desert. This fringe is exceedingly populous. From one town to the other you find scattered along the roads innumerable houses, so that it is impossible for a stranger to say where one village begins and the other ends; they dovetail into one another, as it were. In the interior the rare population is concerned with silk, lacquer, pottery, etc.; but in this fringe there is scarcely anything but rice culture. The sea washes, penetrates, at times partly covers by its tides, the coast-land, and furnishes the constant dampness necessary for the growth of rice. The sea takes away multitudinous parcels of the rice coast by forming swamps; and sometimes seems to be intent on compensation by giving something of its own; thus, for instance, a portion of the city of Tokio, now inhabited by 120,000 people, and which 200 years ago was under water, may be considered as a gift of the ocean.

The traveller in Japan is forcibly reminded of the cities of Egypt, perched upon their elevated seats during the overflow of their grand river. Here the inundation is an artificial one; the waters of the innumerable swamps formed, either by the sea or by the rivers, have been directed into the rice fields all around the villages, and the latter appear like islands. Even when the time of the flooding is ended, shallow marshes remain everywhere, for the drainage is imperfect, to say the least. The stork, the king of the swamps, is the national bird of Japan, semi-sacred, and, in olden times, Mikados and Tycoons alone were allowed to eat of it.

We must also, in an article on rice culture in Japan, take into account the exuberant canal system of that country. The traffic of the country is almost all on the canals, which join one river to the other, and form a network of filthy water over the whole extent of the densely populated zone. I said of filthy water, for it contains all the surface drainage of the large cities. Garbage² is continually, or rather systematically, thrown into the deep, elaborately built, stone gut-

ters in which there is a perpetual flow of water, so that even a regular eel fishery goes on in them. These gutters do the work of our scavengers, without any cost to the city; they carry the city filth into the canals, and from the canals not only to the sea but also into the rice fields. A river is nowhere allowed to pass without paying toll in the form of public service; it enters into the sea only after it has washed the cities which it met in its course. On its surface it carries still more filth, if possible, than in its waters, for the contents of all the public closets, in the streets and in the houses, are daily carted to some boats and brought to the rice fields, to serve as manure. There, at the rice field, the liquid manure is preserved in tanks until the proper time has come for using it, after the drainage of the plantation, when the farmer feeds the growing plant by pouring over its roots with a dipper. The solid part is applied to the soil before the planting.

From all this it appears that the culture of rice in Japan is naturally a thorn in the side of the medical profession.

The first evil resulting from this occupation in Japan is impaludism, which is exceedingly frequent in all the rice plains until the monsoons of the spring and the autumn sweep away most of the paludic emanations.

Typhoid fever and its complications, together with other pernicious types, and the diseases caused by the distoma are due to the infection of drinking water by their deleterious system of manuring and draining.

It has occurred to several leprologists that there may be a connection between lepra and impaludism. It is a fact that the more malarious the situation of a sea-coast the greater is the number of lepers there. Moreover, it may be considered as a significant fact, that the first outbreak of leprosy is, in a large number of cases, in China as well as in Japan, preceded by one or several attacks of paludic fevers. It has even been suggested that the origin of leprosy might be in the malarious mud through which the rice laborers are continually wading. So much for Japan.

The situation in Mexico, a country allied with Japan in many ways, in climate, in constitution of inhabitants, irrigation system, etc., is aptly described by Dr. Nazario Lomas, member of the Board of Health of the State of Morelos, Director of the General Hospital, Cuernavaca (Morelos), Mexico. His paper on the subject was read in Kansas City (United States) before the American Public Health Association, Oct., 1891. I give here the essential part of it: "During the last five years the cultivation of rice by irrigation has become one of the chief elements of the prosperity of this State (Morelos, Mexico). In course of these five years we have seen the plantations increasing rapidly, while a corresponding deterioration was observed in the salubrity of neighboring towns. And how could it be otherwise, seeing that the rice swamps are exposed to a mean temperature of 33 degrees centigrade in summer and 28 degrees in winter?

"I think I need not here enter into any details about the cultivation of rice; in a general way, quite sufficient for my purpose, every one is acquainted with this subject. Let me only remind the reader that there are two systems of cultivation: dry (on hills), and by irrigation. The latter has two sub-divisions, irrigation by current and irrigation by flooding.

¹ Communicated to the Sei-I-Kwai, or Society for the Advancement of Medical Science in Japan.

² However it must not be forgotten that garbage in Japan is of a more simple and less lurid kind than ours; it consists chiefly of the refuse of fish and vegetable diet; no meat bones, no stale bread or other characteristics of our own garbage.

"The sytem of irrigation by flood, which, happily, we do not know as yet in the State of Morelos, but which is likely enough to be introduced by and by, as the rice culture progresses, is the worst of all. It is this system especially that is meant when competent authorities denounce the cultivation of rice as homicidal, declare its history to be one of blood, and contend that every sixteen hectolitres of rice are bought at the price of one man's life. This form of irrigation is said by experienced men to combine in the most effective manner all the evils of the very worst of sweet-water swamps.

"The rice cultivated under the current system, now generally adopted in this State, is irrigated from February to September by means of currents, renewed according to the necessities of the plant, but generally continuous. Now as perfect slopes are rare, the drainage is rarely, if ever, complete, so that every field of any considerable extent presents hollows ready to receive swamps. Moreover, the want of canals and drains, or their imperfection, is cause that at the points of entrance and exit the irrigation water diffuses itself in lagoons. But supposing even this system to be carried out in the most perfect manner, without any flaw, there remains still the evaporation, on an immense surface, from a soil exceedingly rich in organic matter. The harvest begins in September. It leaves on the ground, more or less damp and swampy, a large quantity of vegetable detritus, whose decomposition fills the air with most pernicious, because ever renewed, poison.

"As to the dry system, which is used on hill-sides, I am not practically acquainted with it. Of course it is not as unhealthy as the two others, but then it is less productive.

"Now, if once we have created in our midst this class of artificial morasses, with a large superficial extension, we find safely established among us the paludic fevers and all classes of gastro-intestinal affections. These are always endemic in the districts where rice is cultivated.

"Each progress of the rice culture is followed by a correspondent advantage gained by the fever. More than fifty per cent of the field-hands are attacked by it. It appears under all its forms, but mostly under those of daily intermittent, tertiary, and continuous fever; in the first two cases it is accompanied almost at the onset with swelling and hardness of the spleen, and very frequently of the liver. It is to be observed that the continuous or remittent fevers do not at once appear as such, they are usually preceded by two or three attacks of daily intermittent fever, whose duration gradually increases until the disease becomes continuous or remittent. Notwithstanding its paludic nature, this fever is not amenable to any form of quinine. Neuralgia, especially in the form of trigeminus, urticaria, and purple spots, is very frequent. Pneumonia becomes here an epidemic, and is cured, or very favorably influenced, by the use of salts of quinine: this observation is continually made in the battalions which come from the south. The day-laborers who come down from the central table-land and the Valley of Mexico are almost invariably affected with cachexia on their arrival.

"I think this is the place to give a few details concerning the physical geography of the State of Morelos. It forms an inclined plane from north to south. Its highest parts are 2,000 metres, and the lowest 500 to 650 metres above the level of the sea. The prevailing winds by day are from south to north, by night from north to south.

"There is an abundance of water, both from springs and rivers; the former is sweet, the latter sweet and salt.

"The course of the waters is naturally opposed to the formation of lagoons or swamps, and the climate must have been very healthy in former times.

"It is in the lower part of the State that the rice is cultivated. It grows there in company with the sugar-cane, another cause of paludism.

"The hygienic measures which the State Board of Health submitted to the approbation of the government, through my initiative, are as follows:—

"1. The cultivation of rice by the flooding system is, in no case, to be allowed, even as a trial.

"2. No new rice plantation shall be established, without a license from the government, for the granting of which, the Board of Health is to be consulted, the State engineer to be a member of such Board. The Board will appoint a committee to study the subject, composed of one of its members residing in Cuernavaca, a physician from the rice districts, who may be a corresponding member of the Board, and of the State engineer.

"3. If the ground, in which it is proposed to cultivate rice, is situated to the south or north of any village or town, and distant therefrom less than 3,000 metres, the petition shall be at once rejected, unless, in the opinion of the health experts, not less than three in number, the three being unanimous, an intervening hill, or forest, or other such natural feature, removes the danger.

"4. Any rice-planter who shall commence his harvest with the ground in a soaked condition, if such condition is due to bad management or carelessness, the waters not having been removed in due season, shall be liable to a fine of not less than \$50, the amount to be fixed in consultation with the governor, and to be deposited with the funds of the State.

"5. The cultivation shall be suspended on any plantation, in which, in the opinion of the engineer of the Board, the irrigation waters form swamps or lagoons, either at the entrance or at the outlet. Once these defects removed, the permission to cultivate may be renewed.

"6. Any person may denounce before the Board, or its correspondents in the district, any defects in the irrigation or cultivation, which may cause the formation of swamps.

"7. Whenever the rice is beaten down by strong winds, hail-storms, etc., it must at once be cut, and especially if it is in the water.

"8. The laborers employed in the rice culture will begin work after sunrise, and will leave the fields before sunset.

"9. The overseers will, under no circumstances, allow the wives of the laborers to bring them their meals or visit them in the fields. This prohibition applies with still better reason to children.

"10. The owners and administrators of rice plantations, who have the well-being of their laborers at heart, may apply to the State Board of Health and obtain from it a pamphlet setting forth the rules to be observed for the prevention and cure of paludic fever."

There is a large rice culture in the United States also. How large is shown by the following numbers, which I have obtained from the U. S. Department of Agriculture. In 1879 the census data for the crop were as follows:—

	Pounds.
South Carolina	52,077,515
Georgia	25,369,687
Louisiana	23,188,311
All other States	9,495,860
Total	110,131,373

Estimates by State Commissioners of Agriculture are available for recent years for South Carolina and Louisiana. The figures of production for the last three years at hand are:—

	South Carolina.	Louisiana.
1888	67,752,374	51,414,909
1889	93,143,508	63,330,897
1890	68,091,944	

The production for Louisiana for 1890 is given at about 1,000,000 barrels of rough rice.

The largest cultivator of rice in the United States is probably Col. John Screven of Savannah, Ga. It is to the kindness of this gentleman that I am indebted for the following information, relating to the rice culture in Georgia and the Carolinas (I leave Louisiana entirely out because the situation there is complicated by the presence of the sugarcane culture).

"There are only two systems: tide-water, and inland or back-water culture. In the latter system, the water is derived from swamp or still-water reservoirs, formed by banking in the water of swamps and so retaining it convenient for the irrigation of adjacent fields. The culture of such fields is practically the same as in tide-water culture, the water being applied and removed at pleasure, provided the reservoirs or back-waters are sufficiently supplied, as may not be the case in seasons of drought. In the former, or tide-water system, a want of water-supply can scarcely occur, certainly not at the periods of spring tides, on which the system of irrigation is commonly based.

"The tidal lands lie in the deltas of the rivers and in their natural state are subject to overflow, certainly in the spring-tides, and being extremely level may be covered by 'great tides'¹ to a depth to hide summits. As these lands contract and settle under drainage and cultivation, this advantage is increased after they are taken in.

"They are embanked sufficiently to keep out the highest tides, and water gates, called "trunks," are laid, so as to admit or discharge the water, as the tides rise or fall. At these gates the drainage fall is from four to five feet in the Savannah River, where the mean tide-fall is about six and a half feet. The average drainage of the fields, however, will not exceed three and a half feet. To make the drainage as complete as possible, main ditches, say six feet wide by four feet deep, are dug around the fields, which are again subdivided by minor ditches, 2 feet wide by three feet deep, called quarter drains, cut parallel about seventy-five feet apart. This ditch system is not all-important for irrigation. It combines greater value in the rapid and thorough drainage it affords; for rice is an amphibious plant, and while irrigation is very necessary to its successful growth, good drainage, the more rapid the better, is equally necessary, for reasons which need not be stated here, as we have to consider only its hygienic value."

I had addressed to Col. Screven a number of questions relating to this subject. I give them here with the answers I received.

1. Which is the least dangerous of the different systems of irrigation? Answer. The tide-water system, because the water is not taken from stagnant reservoirs, and may be oftener changed.

2. What is the system of manuring generally adopted, are human excrements used? Answer. Commercial fertilizers are more commonly used—human excrements *never*.

¹ This is the almanac term for the high spring tides raised by the union of new or full and perigee moon—not storm-tides.

3. What means are used to prevent the contamination of drinking water? Answer. Water from wells, sometimes artesian, is used, very commonly water drawn directly from the river, which, by the more careful, is cleared by settling, or is filtered.

4. What seasons are most unwholesome for the cultivators? Answer. The summer and ante-frost autumnal months, commencing with July and the harvest flow, and especially after that flow is removed, say, from August 15, when it is cast off for the harvest, and the water-growth, animal, and vegetal exposed to the sun and decay.

5. Do the hands live in the immediate neighborhood of the plantations or, perhaps, on higher ground? Answer. Either, as convenience dictates, or on the plantation itself. Very often higher grounds are more unwholesome than the level of the rice-fields. Settlements close to the river-shore, where the tides move the atmosphere, and the winds are least impeded, are often the most healthy. High grounds overlooking rice-fields, and not well-shielded from them by vegetation, are considered most unwholesome. It should be stated that the cultivators (laborers) in the rice-fields are negroes, who are constitutionally less liable to fevers than whites. Ordinarily, the white residents of rice-fields abandon them from May 1 until frost the following autumn.

6. What system is used to dry the ground? Answer. The drainage method already described. The rice-fields are never pondy or muddy when properly drained. During the dry stages, they admit the plow, harrow, toothed roller, drill, or any other appropriate agricultural implement, and are sometimes even dusty, when stirred.

7. What is done to prevent the formation of swamps or lagoons? Answer. Effective drainage.

8. Is anything done to prevent infection from the rotting crops which have been beaten down by storms? Answer. When drainage is effective, serious infection is not likely to occur from crops beaten down by storms.

9. Are laborers permitted to work in the rice-fields before sunrise and after sunset? Answer. The most dangerous time to laborers is in the harvest, when the hot suns raise noxious effluvia in the fields from decaying water vegetation and animalculæ. At such times the laborers (negroes) seek their work in the early morning before sunrise, so as to complete their tasks before afternoon, when the sun is most oppressive. They fear the sun more than malaria.

10. What means are taken to obviate malarial and typhoid fevers? Answer. None specially; incidentally such drainage as is necessary to successful rice culture Drainage and good health are as interdependent as drainage and good husbandry. As for *typhoid fever*, it is *unknown in the rice-fields, even among whites*. Filth diseases are rare. If by "malarial fevers" is meant fevers other than those from paludal (marsh) causes, I venture to assert that in the rice-fields, and on the southern Atlantic coast generally, there is marked absence of them, and where fevers prevail from paludal (marsh) causes (bilious fevers?) typhoid fever will not originate. It is a notable fact, that typhoid fever was unknown in the city of Savannah before 1861.

In conclusion, I will in a few words give such advice to Japanese sanitarians as is clearly suggested by the preceding facts. 1. First of all, there is one thing that must be done if the culture is not to remain what it is now, a public calamity; the immunditiæ must be kept out of the water. I should advocate the use of artificial manures, — bone phosphates and American fertilizers. Thus the general infection of drinking water with typhoid, cholera, and other germs, would cease.

2. It would be worth while, perhaps, if a trial was made to obtain negro labor for the rice plantations. The negro is proof against malarious influences in a considerable measure. Might not colored laborers be imported from Georgia and the Carolinas?

CURRENT NOTES ON ANTHROPOLOGY. — XI.

[Edited by D. G. Brinton, M.D., LL.D.]

Canadian Archæology.

UNDER the efficient superintendence of Mr. David Boyle, curator, the archæological collection of the Canadian Institute, Toronto, has grown to be the largest in existence, illustrating the prehistoric condition of man in the province of Ontario. His excellent reports, which have appeared annually since 1887, describe with great accuracy and sufficient fullness the yearly accessions to the collection of antiquities.

Objects which can properly be called palæolithic have not yet been found in Canada. This is the opinion of Mr. Boyle as expressed in his last report. Of course, forms simulating those of the old stone age occur, but this is not conclusive. Stone is the principal material, and in its shaping and dressing the Canadian Indians were not behind their neighbors to the south. The collection also contains many specimens of their pottery. It is well burned, ornamented with designs in scroll and line, and some of the vases are "almost classic in outline." The pipes, both stone and clay, are a prominent feature in the reports, and evidently were the objects of solicitous workmanship. Copper specimens are by no means unusual, some being knives, others spear-heads, with planges and sockets, others ornaments, as beads, bracelets, etc. Examples in bone, shell, and horn are also figured. About a hundred of the crania unearthed have been examined. They indicate a people with moderately dolichocephalic skulls, averaging a cranial index of 74.5.

It is to be hoped that the government of the Dominion will continue to lend assistance to this creditable effort to illustrate the archæology of Ontario.

The Question of the Basques.

As some readers of *Science* have manifested an interest in the Basques, they will doubtless be pleased to learn that at the next meeting of the French Association for the Advancement of Science, to be held at Pau, from the 15th to the 22d of September next, the Anthropological Section intends to devote most of its energies to settling "La Question Basque." According to an announcement of the President of the Section, Dr. Magitot, the question is to be attacked on all four sides: first, the history and origin of the Euskarian people; next, their anthropological characters; third, their language; and finally, their traditions and folk-lore. From such an onset as this we may hope for some positive results.

Not much can be expected from a study of the language. There is probably no other living idiom which has had its vocabulary so completely foreignized as the Basque. At the Congr s Scientifique International des Catholiques last year, the Comte de Charency, who is a good authority on the tongue, stated that at least nine-tenths of its words were borrowed from the Latin and Romance languages, and then proceeded to point out that a considerable percentage of the remainder were Celtic, Greek, or Germanic in origin. There is almost nothing left of the original Euskarian but its grammar; and this, it may be added in passing, shows no relationship to that of either Ural-Altaic or American tongues, in spite of various statements to the contrary.

On Left-Handedness.

Why are most people right-handed? Why are a few left-handed? These are questions which have puzzled all physiologists who have attempted their solution. The various theories put forward are compactly presented by Sir Daniel Wilson in his recent work, "The Right Hand: Left-Handedness" (London, 1891). His final conclusion is that left-handedness is due to "an exceptional development of the right hemisphere of the brain." But it must be acknowledged that his evidence, consisting of a single autopsy, is far from sufficient.

Sir Daniel calls attention to the fact that the forms of some ancient stone implements prove that palæolithic man was sometimes left-handed, and distinctly was not ambidextrous, as some have maintained. He does not refer to De Mortillet's tables in the Bull. Soc. D'Anthropologie, 1890, which show that at that time in France the men averaged more than twice as many left-handed individuals as at present; and at certain localities, as at Chassey, on the upper Rhone, the left-handed were in the large majority.

In Sir Daniel's generally very thorough volume there are but few references to this phenomenon in the lower animals, and no mention of its occurrence in snails. It may, indeed, sound like a "bull," to talk of animals as left-handed who have no hands, but the physiological phenomenon is plainly present. It is shown in the direction in which they construct the spiral of their shell. With the ordinary vine snail this is from left to right; but once in about 3,000 times it is from right to left. They are then known as *sinistrorsa*. In the genus *Partula* far more frequent examples occur, and indeed species have been named from this peculiarity. Whatever its cause, in mollusk and in man the same law is operative.

The Mentone Cave-Burials.

Near Mentone, but on the Italian side of the frontier, there are several caves in the cretaceous sea-cliffs, whose contents have long attracted the lively attention of archæologists. Unluckily, they have been worked over so much that the original stratification is no longer apparent; but throughout the mass, flint chips and rude bone implements have been abundantly found, of such a character that they have been unanimously referred to palæolithic man, to that period of his existence in western Europe which De Mortillet has called Solutreen.

Thus far, all is harmony; but in this deposit, at various depths, skeletons have been unearthed, and a lively discussion ensued as to whether these should be considered also of palæolithic time, or of later date. This debate has been renewed by fresh discoveries of such remains in February last, a good description of which, by Mr. A. Vaughan Jennings, appears in *Natural Science* for June. They are said to be of unusual size, relics of men from six and a half to seven feet tall; but it is well known how easily one is deceived in measuring skeletons. With them were worked ornaments of bone and shell, necklaces, and finely-chipped arrowheads. These indications point conclusively to the fact of deliberate interment at a period when mortuary ceremonies were definite and solemn rites, and unquestionably, therefore, to neolithic times. In spite of the depth at which they were found, perhaps twenty-five feet below the modern level of the cave floor, they must be accepted as endorsing De Mortillet's rejection of the human remains as palæolithic.

Ethnology as Philosophy.

Among the most thoughtful writers on the meaning and mission of ethnology must be named Dr. A. H. Post of